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ABSTRACT

This study investigated changes between 1987 and 1996 in the proportions of ACT-tested students taking or planning to take high school mathematics and science courses prior to high school graduation. The changes in course-taking patterns among racial/ethnic and gender subgroups were also compared. The seven courses studied were Algebra II, Geometry, Trigonometry, Calculus, Other Advanced Mathematics, Chemistry, and Physics. In general, the percentages of students taking advanced mathematics and science courses increased for all racial/ethnic and gender groups. However, the increase was greater for females than for males; it was also greater for American Indians, Mexican Americans, and Blacks than for Other Hispanics, Asians, or Whites. Similarly, greater increases were observed in the average ACT Composite and ACT Mathematics scores of females, American Indians, Mexican Americans, and Blacks. In contrast, total group average ACT Composite and ACT Mathematics scores remained stable or increased only slightly. During the time period, the percentage of females and minority students in the ACT-tested population increased. Contains 25 references. (Author)

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Trends in Advanced Mathematics and Science Course Taking and Achievement Among ACT-Tested High School Students: 1987-1996

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Abstract

In this study we investigated changes between 1987 and 1996 in the proportions of ACT-tested students taking or planning to take high school mathematics and science courses prior to high school graduation. We also compared the changes in course-taking patterns among racial/ethnic and gender subgroups. The seven courses studied were Algebra II, Geometry, Trigonometry, Calculus, Other Advanced Mathematics, Chemistry, and Physics. In general, the percentages of students taking advanced mathematics and science courses increased for all racial/ethnic and gender groups. However, the increase was greater for females than for males; it was also greater for American Indians, Mexican Americans, and Blacks than for Other Hispanics, Asians, or Whites. Similarly, we observed greater increases in the average ACT Composite and ACT Mathematics scores of females, American Indians, Mexican Americans, and Blacks. In contrast, total group average ACT Composite and ACT Mathematics scores remained stable or increased only slightly. During time period, the percentage of females and minority students in the ACT-tested population increased.

Trends in Advanced Mathematics and Science Course Taking and Achievement Among ACT-Tested High School Students: 1987-1996

Introduction

> *Courses in mathematics and science can teach students to use higher level thinking skills to solve complex problems. These skills are considered valuable both in educational and marketplace settings. Analysis of course taking patterns of high school graduates can indicate levels of exposure in these fields for individuals about to advance to higher education or enter the workforce.* (U.S. Department of Education, National Center for Education Statistics [NCES], 1996, p. 100)

When schools prepare youth with strong education credentials, they open doors to brighter futures. Strong preparation in mathematics and science can spell success in many quantitatively-based college majors—majors in which females, Blacks, American Indians, and Hispanics have been historically underrepresented (Vetter, 1994; Blank & Gruebel, 1995; Berryman, 1983). Skills taught in high school mathematics and science courses are important in everyday life as well as in today's changing workplaces. High school students trained in these areas are able to choose from wider arrays of college majors and occupational choices than are those who lack such preparation. They are also better prepared to lead rewarding lives in today's technologically oriented society. Despite these advantages, women and underrepresented minorities—American Indians, Blacks, and Hispanics—have tended to take fewer advanced high school mathematics and science courses, have earned fewer degrees in science and engineering at every level,

and have been less likely than White males to be employed in science and engineering fields (National Science Foundation, 1996).

Raising the level of achievement in mathematics and science has been one of the nation's educational imperatives for over a century, but progress toward this goal has not been steady. As early as 1893, the National Education Association's (NEA) Committee of Ten on Secondary School Studies urged that all high school students be educated in traditional core academic subjects, including mathematics and science (Raubinger, Rowe, Piper, & West, 1969). In its final report, the Committee of Ten recommended that subject areas not be treated differently for the college-bound and the non-college-bound.

By the 1920s, however, another influential NEA-sponsored group, the Commission on the Reorganization of Secondary Schools, had laid a markedly different set of directions about how secondary schools should prepare students. Instead of insisting that schools focus on core subject areas, the Commission created and promoted the Seven Cardinal Principles of Education and called for schools to concentrate on students' present and future life activities—those related to health, command of fundamental processes, home membership, vocation, citizenship, worthy use of leisure, and ethical character (French, 1967). By the late 1940s, the traditional core subjects were often combined into a large block called the *core period* in order to make time in the curriculum for an array of other new courses that emerged as part of "life adjustment education" (Ravitch, 1983, p.66). With the Cardinal Principles and its offspring, the life adjustment movement, the task of education had become less a matter of training and disciplining

of the mind—as advocated by the Committee of Ten—and more a "process of developing social and civic awareness and responsibility" (Latimer, 1958, p.117). While some might reasonably argue that mathematics and science were expected to be integral to the Cardinal Principles, the fact remains that course taking in traditional core areas declined significantly, beginning in the 1920s and continuing for half a century (Angus & Mirel, 1993a, 1993b).

Although the U.S. Office of Education had given full support to the campaign for life adjustment education (Ravitch, 1983), it also became concerned about the decline in mathematics and science course taking. To address this drop, that agency began a series of national surveys of science and mathematics teaching in 1948. The two rationales for this effort were that (1) the general population needed to understand the nature of mathematics and science and (2) schools and colleges needed to train more scientists, engineers, and teachers of mathematics and science (Angus & Mirel, 1995). The first resembles Berliner & Biddle's (1995) rationale for teaching mathematics and science to promote the quality of life in a democracy. The second is more closely associated with workplace demands for trained personnel. The launch of Sputnik in October 1957 heightened the nation's interest in the preparation our students were receiving in mathematics and science. Federal monies were used to purchase science equipment for schools and many new curriculum materials were developed, especially in mathematics and science.

By the mid-1980s, the percentage of course-takers in the academic core subjects including mathematics and science increased. States and districts began to respond to

recommendations in *A Nation at Risk* (National Commission on Excellence in Education [NCEE], 1983). The first of the recommendations called for all high school students to take more academic courses before they receive a diploma.

> *As our society depends increasingly on science and technology, it is important that all citizens have an understanding of the nature of science and mathematics. The continued security and growth of the United States in this age of technology require steady increases for many years to come in the Nation's supply of high quality engineers, scientists, and teachers of mathematics and the sciences.* (The President's National Committee for the Development of Scientists and Engineers, cited in Brown & Obourne, 1957)

More than a decade ago ACT began asking students registering for the ACT Assessment to indicate which of 30 high school courses they had taken or were taking, which they had not taken but would take, and which they had not taken and would not take prior to high school graduation. In this study we focus on course-taking patterns for 7 of the 30 courses.

Purpose of This Report

The purpose of this report is to summarize 1987 to 1996 trends in the proportions of ACT-tested students taking or planning to take advanced high school mathematics and science courses prior to high school graduation. We present trends for the total group and by gender and racial/ethnic group. Specifically, we focus on seven

courses—Algebra II, Geometry, Trigonometry, Calculus, Other Advanced Mathematics (i.e., other mathematics beyond Algebra II), Chemistry, and Physics. The report also presents average ACT Composite and Mathematics test score trends from 1987 to 1996 by gender and racial/ethnic group.

Related Studies

In a study of the impact of national educational reform on high school students' course selection patterns, Bartell and Noble (1990) reported increases in the number of core courses taken among ACT-tested college-bound students between 1978 to 1988. These shifts paralleled the recommendations in *A Nation at Risk* (NCEE, 1983) to the effect that course taking in the four core subject areas should increase. The Bartell and Noble (1990) study established cutoffs based on NCEE recommendations for the number of years of courses taken in each core subject area and found that "...those responding to curricular reforms were more often the very groups that previously had lower levels of exposure to core academic courses: women, students from lower income families, and minorities" (p. 275). Measurements were limited to 1978, 1982, and 1988. The study did not examine subsequent achievement.

Another study (Horn, 1990) examined high school transcripts collected in four national surveys between 1969 and 1987 and documented the number of credits earned in particular mathematics and science classes. Concluding that students were completing more mathematics and science courses during their high school years, the study noted that the gender gaps in mathematics and science were narrowing, even though females

continued to lag behind males in course completion. Horn found that Blacks and Hispanics persisted in taking the most basic courses and took the fewest advanced level courses, while Asians exhibited the reverse pattern. In the last year of the study, Asians were earning twice the number of mathematics and science credits earned by Whites, and Whites were earning twice the number of credits earned by Blacks or Hispanics. The Horn study did not examine corresponding relationships with achievement.

A recent study (Hoffer, Rasinski, & Moore, 1995) examined data from the 1992 follow-up survey of the National Educational Longitudinal Study of 1988 (NELS:88) to explore the relationship between the number of high school mathematics and science courses students take and their achievement on standardized tests. The study found that (1) increases in test scores are strongly related to the number of mathematics and science courses completed in high school, (2) these gains occur regardless of gender, race-ethnicity, and socioeconomic class, (3) students from families in higher socioeconomic brackets complete more of these courses, and (4) females do not differ significantly from males in the numbers of mathematics and science courses they take.

Although states and districts have improved, most continue to fall short of the goals outlined in the NCEE (1983) recommendations. Whereas in 1980, 35 states were requiring only one year of mathematics and 36 were requiring only one year of science for a diploma, 10 years later, about two fifths of students were in districts requiring three or more years in mathematics for graduation, and about one fifth were in districts requiring three or more years in science (U.S. Department of Education, National Center for Educational Statistics [NCES], 1995). By 1995, the Council of Chief State School

Officers reported in their *State Indicators of Science and Mathematics Education, 1995* (Blank & Grubel, 1995) that for the 38 states reporting, 60% of all students had reached the third year of high school mathematics (i.e., Algebra 2/Integrated Mathematics 3 or Level 3), and 10% had reached Level 5 (i.e., Calculus or Advanced Placement Calculus). In science, 51% had reached first-year Chemistry, and 22% had reached first-year Physics.

Method

Data

We obtained data for the study from ACT Assessment Program history files containing test information for students from the high school graduating classes of 1987 through 1996. The total ACT-tested population for each year ranged from 777,444 in the 1987 high school graduating class to 945,369 in the 1995 graduating class (see Table 1). Using systematic sampling, we selected 10% of the ACT-tested, high school graduating class from each year, 1987 through 1996. Each student record in the ACT history file contains information about ACT scores, gender, racial/ethnic group and course-taking information.

Instrument

The ACT Assessment includes four tests of educational development, the *High School Course/Grade Information (C/GI)* section, the *ACT Interest Inventory (UNIACT)*, and the *ACT Student Profile Section (SPS)*. The four tests—*English, Mathematics, Reading, and*

Science Reasoning—assess student achievement in these areas. The ACT Composite score is the average of the scores for the four subject area scores. The possible range of scores for each test and for the ACT Composite is 1-36.

As the predominant college admission test in 26 states in the United States, the ACT is taken each year by nearly a million college-bound students. ACT scores are accepted by virtually all colleges and universities in the country. Nevertheless, the population of ACT-tested students is not necessarily representative of all high school students or all college-bound students in the country.

The *C/GI* section was added to the ACT Assessment *National Registration Folder* in 1986. In the *C/GI*, students report course taking and grade information about 30 high school courses that are typically found in a college preparatory curriculum and are frequently considered in college admissions decisions. Although these 30 courses do not represent all courses of interest to colleges, ACT selected them to give a basic picture of students' academic preparation. Students are encouraged but not required to complete the C/GI section. Researchers have confirmed that student-reported course data from the C/GI are fairly accurate in approximately 95% of the cases (Valiga, 1987) and are "sufficiently high to be useful in many contexts" (Sawyer, Laing, and Houston, 1988, p. 12).

The *SPS* contains approximately 200 questions in 12 categories related to students' characteristics, background, educational and vocational aspirations, plans, abilities, accomplishments, and needs.

Procedures and Definitions

For this study, students were grouped by high school graduating class—not by the year in which they took the ACT. For example, juniors who took the ACT tests during academic year 1994-95 and seniors who took the test during academic year 1995-96 were combined to constitute the graduating class of 1996. In the 1996 graduating class, approximately 36% were juniors and 62% were seniors.

We selected the study's 7 mathematics and science courses from the 30 courses listed in the C/GI section. Among the mathematics courses is one entitled "Other Mathematics Beyond Algebra II", through which students may indicate other advanced mathematics courses taken or planned. In our analysis, we treated this item as one course, *Other Advanced Mathematics*, even though it may refer to one or more of several courses not listed in the C/GI section—for example, analytic geometry, linear algebra, statistics, and calculus II.

To investigate changes in mathematics and science course taking from 1987 to 1996, we simply compared the overall percentages of students taking each course by graduating class for various subgroups of students based on gender and racial/ethnic group. We also examined changes in average ACT Mathematics and Composite scores over the period but did not conduct any causal analyses.

Prior to analysis, ACT scores for all years before 1989 were converted to comparable scores for the present Enhanced ACT scale (ACT, 1989). We eliminated all duplicate student records and all records with invalid ACT scores. We also discarded records for which there was inadequate course and grade information. To determine

whether a student supplied adequate course and grade information, we counted the number of responses to the 30 courses in the C/GI section and eliminated all records with fewer than three marks in that section. For all remaining records, we examined responses to each of the seven courses to determine whether to count it as "taken". When no mark was made to indicate information about a course, we looked to see if a grade was reported. For purposes of this paper, we considered a course as *taken* if the student reported that he or she (1) had taken or was currently taking it, (2) had planned to take it prior to graduation, or (3) reported a grade for it.

We have abbreviated the names of racial/ethnic groups. In the right-hand column below are names as they appear in the ACT SPS; in the left-hand column are the abbreviated names used in this report.

• American Indian/Alaskan Natives	*American Indians*
• Asian-American/Pacific Islanders	*Asians*
• African-Americans/Black	*Blacks*
• Mexican American/Chicanos	*Mexican Americans*
• Puerto Rican/Cuban/Other Hispanic	*Other Hispanics*
• Caucasian American/Whites	*Whites*
• Other, prefer not to respond, blank	*Others*
• Multi-racial (in 1996)	*Others*

Results

Changes in the Population of ACT-Tested Students

The ACT-tested student population increased by 18.9% between 1987 and 1996 (see Table 1). The number of students from various racial/ethnic groups and gender groups grew at unequal rates.

Gender groups. Females outnumbered males in the ACT-tested population in 1987 and outnumbered them even more in 1996, increasing from 54.1% to 56.0% of the ACT-tested population. Between 1987 and 1996 the number of ACT-tested females increased 22.9% and the number of males increased 14.3%. (See Table 1 and Figure 1.)

Racial/ethnic groups. Table 1 also presents percentage increases by racial/ethnic group between 1987 and 1996. The number of Blacks taking the ACT Assessment increased from 62,200 in 1987 to 87,630 in 1996—a 40.9% increase; Other Hispanics increased 241.6% from 7,570 to 25,857; Asians increased 101.9% from 13,790 to 27,847; American Indians increased 57.3% from 7,360 to 11,580; and Others increased 64.5% from 58,390 to 96,027.

Changes in Overall ACT Composite and Mathematics Scores

Because a more diverse population of students is now completing the ACT Assessment, one might expect decreases in the average ACT Composite and Mathematics scores. However, even though considerable change occurred in the population size, in its racial/ethnic composition, and in the percentages taking advanced high school

mathematics and sciences courses, the average ACT Composite and Mathematics scores for the overall samples have varied only slightly during the past 10 years. The ACT Composite score increased from 20.7 in 1987 to 20.9 in 1996, and the ACT Mathematics score increased from 20.0 in 1987 to 20.3 in 1996. Greater variations, however, occurred for some of the racial/ethnic and gender subgroups. (See Tables 2, 3, and 4 and Figures 4 and 5.)

Between 1987 and 1996, females' average ACT Composite score rose by 0.6 points (from 20.2 to 20.8), while males' ACT Composite score declined by 0.4 points (from 21.4 to 21.0). The largest ACT Composite score gains by racial/ethnic group included a 1.3 point increase from 17.3 to 18.6 for American Indians, a 0.9 point increase from 17.9 to 18.8 for Mexican Americans, a 0.6 point increase from 16.5 to 17.1 for Blacks, and a 0.7 point increase from 19.7 to 20.4 for Others.

Students from groups with the greatest percentage point gains in mathematics and science course-taking also made the largest gains in ACT Mathematics scores (see Table 5). For example, between 1987 and 1996 the percent of American Indians taking Algebra II rose from 59% to 83%. During the same period the ACT Mathematics score for American Indians increased by 1.2 points. Females—whose course taking increased more between 1987 to 1996 than that of males—had ACT Mathematics test scores that rose by 0.5 points (from 19.2 to 19.7).

The largest ACT Mathematics score gains by racial/ethnic group were for American Indians (1.2 points from 16.8 to 18.0) and Mexican Americans (1.2 points from 17.5 to 18.7). Blacks' Mathematics scores rose by 0.9 points (from 16.0 to 16.9), and

Others' Mathematics scores rose by 0.7 points (from 19.3 to 20.0). In 1987 males' average ACT Mathematics score was 1.8 points higher than that of females (21.0 compared to 19.2, respectively), but by 1992 and continuing through 1996, males' Mathematics score was no more than 1.2 points higher than that of females (see Table 3).

Increases in Course Taking of Advanced Mathematics and Science Courses

The overall proportions of the ACT-tested students taking advanced mathematics and science courses increased gradually between 1987 and 1996 (see Tables 4 and 5 and Figure 6). In 1996, the proportion of students taking Chemistry was higher by 13 percentage points than in 1987. We found similar proportional increases for Algebra II (by 12 percentage points), Physics (by 10 percentage points), Other Advanced Mathematics (by 8 percentage points), Geometry (by 7 percentage points), Calculus (by 7 percentage points), and Trigonometry (by 5 percentage points). These gains were shared to some extent, although not uniformly, by all racial/ethnic groups and by both genders.

Algebra II. From 1987 to 1996, the percent of ACT-tested students taking Algebra II increased, regardless of gender or racial/ethnic identity (see Table 6 and Figure 7). American Indian students made the largest gain—from 59% in 1987 to 83% in 1996—a 24 percentage point increase during these years (see Table 5). Similarly, the proportions of Blacks and Mexican Americans taking Algebra II also increased substantially—each group increased by 16 percentage points. Between 1987 and 1996 the proportion of

males taking Algebra II rose from 78% to 88% and the proportion of females taking Algebra II rose even more—from 74% to 89%. (See Tables 4, 5, and 6 and Figure 7.)

Geometry. By 1996, at least 85% of each ACT-tested racial/ethnic group reported taking Geometry. American Indians made a 20 percentage point gain in Geometry course-taking—increasing from 65% in 1987 to 85% in 1996. Similarly, Blacks and Mexican Americans made 14 percentage point gains between 1987 and 1996 and females made a 9 percentage point gain. (See Tables 4, 5, and 7 and Figure 8.)

Trigonometry. The greatest gains between 1987 and 1996 in Trigonometry course-taking were made by Mexican Americans with a 12 percentage point gain, by American Indians with an 11 percentage point gain, and by females with an 8 percentage point gain. During these years the gap between males and females in Trigonometry course taking declined a bit. (See Tables 4, 5, and 8 and Figure 9.)

Calculus. No group increased its Calculus course taking more between 1987 and 1996 than did Mexican Americans and females—each with 9 percentage point gains (see Table 5). However, throughout the 10-year period, Asian students were approximately twice as likely to take Calculus as students from the other subgroups. Between 1987 and 1996 the proportion of males taking Calculus rose from 20% to 25% and the proportion of females rose from 12% to 21%. (See Tables 4, 5, and 9 and Figure 10.)

Other Advanced Mathematics. The overall proportion of ACT-tested students taking Other Advanced Mathematics increased by 8 percentage points between 1987 and 1996, the percentage of females taking Other Advanced Mathematics increased during these years by 11 percentage points (from 29% in 1987 to 40% in 1996). As a result by 1996,

there was no difference in the percentage of males and females taking this course. Mexican Americans made a 10 percentage point course-taking gain (from 22% in 1987 to 32% in 1996). American Indians, Whites and Others each increased their course taking of Other Advanced Mathematics by 9 percentage points during these years, and Blacks increased theirs by 7 percentage points. (See Tables 4, 5, and 10 and Figure 11.)

Chemistry. Overall, the percentage of ACT-tested students taking Chemistry increased more (13 percentage points) between 1987 and 1996 than was the case for any of the other six courses studied (see Table 5 and 11 and Figure 12). American Indians, Mexican Americans, Blacks and females made increases of 20, 19, 18, and 17 percentage points, respectively. The percentage of American Indians taking Chemistry increased from 49% to 69%. By 1996 Chemistry was taken by 76% of Mexican Americans, 76% of Blacks, and 81% of females. (See Tables 4, 5, and 11 and Figure 12.)

Physics. The overall percentage of students taking high school Physics increased between 1987 and 1996 by 10 percentage points (from 35% to 45%). Making the largest course taking gains were females and Mexican Americans (each by 14 percentage points), Others (by 13 percentage points), and American Indians (by 11 percentage points). (See Tables 4, 5, and 12 and Figure 13.)

Summary of Results

In this study we investigated trends from 1987 to 1996 in the percentage of ACT-tested students who had either taken, were currently taking, or were planning to take advanced mathematics and science courses in high school. The seven courses studied

were Algebra II, Geometry, Trigonometry, Calculus, Other Advanced Mathematics, Chemistry, and Physics. We also obtained average ACT Mathematics and Composite scores for the sample and analyzed them by racial/ethnic and gender groups for each of the 10 years from 1987 to 1996.

Highlights of the findings of this study include the following:

- Between 1987 and 1996 the ACT-tested population increased by 19%—14% for males and 23% for females. Population increases from 1987 to 1996 for racial/ethnic groups ranged from 7% for Whites to 242% for Other Hispanics.
- Course taking in mathematics and science increased among all ACT-tested racial/ethnic and gender groups—especially among females, American Indians, Blacks, Mexican Americans, and Others.
- In 1987 larger percentages of males than females were taking each of the seven courses studied. However, by 1996 larger percentages of females than males were taking Algebra II, Geometry, and Chemistry and the percentage of females taking Other Advanced Mathematics was equal to that of males.
- Females not only outnumbered males in the ACT-tested population in each of the 10 years, they also made greater course-taking gains than males in each of the seven advanced mathematics and sciences courses.
- Between 1987 and 1996, American Indians, Blacks, Mexican Americans and Others demonstrated relatively larger increases in course taking in Algebra II, Geometry, and Chemistry. American Indians, Mexican Americans and Others had relatively larger course-taking increases in Trigonometry and Physics. Mexican Americans and Others

had relatively larger course-taking increases in Calculus, and Mexican Americans had relatively larger increases in Other Advanced Mathematics.

- Average ACT Composite and Mathematics scores for American Indians, Blacks, Mexican Americans, Others, and females increased more during the 10-year period studied than did those for other racial/ethnic groups and males.
- Groups that had 1987 to 1996 course-taking gains of at least 13 percentage points in three or more of the seven advanced mathematics and science courses included females, American Indians, Blacks, Mexican Americans, and Others. These same five groups had greater ACT Composite and Mathematics score gains than the other four groups—males, Asians, Whites, or Other Hispanics—whose 10-year course-taking gains were lower.

Discussion

This study found that college-bound students in 1996 were taking more advanced mathematics and science courses than they were in 1987 and that underrepresented minorities and females have experienced relatively larger increases in the percentages of mathematics and science courses taken.

Previous research has shown coursework to be strongly associated with performance on the ACT (Noble, Crouse, Sawyer, & Gillespie, 1992). We found a similar association in this study: Increases in ACT Composite and Mathematics scores were more likely to occur among females and racial/ethnic groups whose advanced mathematics and science course taking increased the most. In general, the proportion

of high school students taking advanced mathematics and science courses increased among all racial/ethnic and gender groups, but more among females, American Indians, Mexican Americans, Blacks, and Others. These increases occurred while the overall averages for ACT Composite and Mathematics scores remained stable or increased slightly and while the ACT-tested population was increasing unevenly across gender and racial/ethnic groups.

Limitations

Three limitations of this study are worth noting. First, even though student groups with the largest increases in course taking also had the largest gains in ACT Composite and Mathematics scores, this relationship is not necessarily causal in nature. Other less obvious factors may have contributed to uneven gains in ACT scores among racial/ethnic groups.

Second, students who indicated *plans* to take a course were included with those who *actually completed* the course or who were *currently enrolled* in it. Furthermore, the percentages of those who were only *planning* to take courses were larger for higher-level courses (e.g., Calculus, Physics) than for lower-level courses (e.g., Algebra II, Geometry). Exploration of such factors are beyond the scope of this paper.

Third, the average ACT scores for 1987 and 1988 were adjusted to the scale for the Enhanced ACT, which was introduced in 1989 (ACT, 1989). Concordance to the 1989 scale may have had a small effect on the statistics we present; given the large sample

sizes and the strength of the concordance relationship, however, the impact on the results should be minimal.

Implications

Mathematics has long been recognized as an area important in providing a wider range of academic and career options (Sells, 1980). When females and underrepresented racial/ethnic minorities do not take sufficient mathematics and science courses in high school, these options are restricted. The results of this study suggest that females and underrepresented minorities are taking more courses.

According to Oakes (1990), women and minorities may differ from white men with regard to three factors that may be linked with attainment in scientific fields, those being "(a) opportunities to learn science and mathematics; (b) achievement in these subjects; and (c) the decision to pursue them" (p. 154). Even if we do not know all we might like to know about how each group is affected, we do know enough to begin making a difference. This report on course-taking trends is further evidence that a reversal is not only possible, it is well underway—at least to the extent that students planning to take courses actually take them. Furthermore, we have reason to suspect that this trend will make a positive difference in achievement, at least on the ACT Assessment (Bartell & Noble, 1990).

Assuming that the national goals are worthwhile, we need more than additional course requirements to reach the achievement levels outlined in *Goals 2000* (National Education Goals Panel, 1995). Societal messages can convey that it is now appropriate

and desirable for females and all racial/ethnic groups to aspire to excel in advanced high school mathematics and science. Such messages can start early. Policy makers, school board members, parents, teachers, guidance counselors—even friends and neighbors—can encourage young children to stay in the mathematics and science pipeline by offering them opportunities that promote positive attitudes toward these subjects. They can talk to elementary and middle/junior high school students about the value of developing interests in and commitments to mathematics and science and help them to understand not only the role of these courses in facilitating wider career choice and career development but also the implications of these subjects for improving the quality of all of their lives. Influential persons can also show students evidence that adequate mathematics and science course taking is paralleled by greater achievement.

Call for Further Research

Although we have examined course taking among racial/ethnic and gender groups taking the ACT Assessment, we have not examined course taking by racial/ethnic groups *by gender*. We need to know more about students who actually completed or were enrolled in advanced mathematics and science courses differ from those who were only planning to take such courses. For example, how do the college majors of students who have taken more high school advanced mathematics and science courses differ from the majors of students who have completed fewer of such courses? How do those who *do* and *do not* take advanced high school mathematics and science

courses differ with regard to what they expect to happen at the end of the educational pipeline? Do their occupational choices differ?

Concluding Thoughts

Our study demonstrates a trend on greater mathematics and science course taking—a trend emphasis that may need further support if females and some racial/ethnic groups are to become equally prepared in these areas. Other related questions may be harder to answer. For example, it may be difficult to learn whether a well-supplied mathematics and science education pipeline (Vetter, 1995; Berryman, 1983) will upset the job-market ecology as some claim (Berliner & Biddle, 1995) or to learn the extent to which the goals outlined in *Goals 2000* (National Education Goals Panel, 1995) were entirely appropriate in the first place. How can we ever know ultimately whether we are giving these academic subjects the proper emphasis? And what will happen if we do not? These difficult questions require our careful thinking and research as we move to the year 2000 and beyond.

On the other hand, we can hope for the best. If we have ushered in the "Learning Society" recommended in *A Nation at Risk* (1983) and inspired by *Goals 2000*, we can hope to have citizens whose minds stretch toward full capacity, who can learn more as the world itself changes, and who can arrive at good answers to these and other difficult questions. Greater achievement in mathematics and science can hardly hurt in this pursuit, and it might help enormously.

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TABLE 1

Frequencies and Percentages of ACT Test-Takers by High School Graduating Class, Gender, and Racial/Ethnic Group: 1987 to 1996

Racial/Ethnic and Gender Groups	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	Percent Change 1987-1996
Total Population	777,444 (100)	842,322 (100)	855,171 (100)	817,096 (100)	796,983 (100)	832,217 (100)	875,603 (100)	891,714 (100)	945,369 (100)	924,663 (100)	18.9
Males	356,704 (45.9)	385,475 (45.8)	391,377 (45.8)	373,310 (45.7)	361,276 (45.3)	374,384 (45.0)	393,707 (45.0)	396,953 (44.5)	416,159 (44.0)	407,587 (44.1)	14.3
Females	420,740 (54.1)	456,847 (54.2)	463,794 (54.2)	443,786 (54.3)	435,707 (54.7)	457,833 (55.0)	481,896 (55.0)	494,761 (55.5)	529,210 (56.0)	517,076 (56.0)	22.9
American Indians	7,360 (0.9)	8,770 (1.0)	9,210 (1.1)	8,700 (1.1)	9,358 (1.2)	9,784 (1.2)	10,384 (1.2)	11,026 (1.2)	11,361 (1.2)	11,580 (1.3)	57.3
Asian-Americans	13,790 (1.8)	16,250 (1.9)	18,480 (2.2)	19,010 (2.3)	20,854 (2.6)	22,771 (2.7)	24,754 (2.8)	26,168 (2.9)	27,784 (2.9)	27,847 (3.0)	101.9
Blacks	62,200 (8.0)	69,740 (8.3)	74,830 (8.8)	70,230 (8.6)	72,681 (9.1)	75,356 (9.1)	80,401 (9.2)	81,806 (9.2)	89,155 (9.4)	87,630 (9.5)	40.9
Mexican Americans	17,870 (2.3)	19,390 (2.3)	23,470 (2.7)	22,400 (2.7)	23,837 (3.0)	26,163 (3.1)	27,713 (3.2)	29,558 (3.3)	24,431 (2.6)	21,345 (2.3)	19.4
Other Hispanics	7,570 (1.0)	8,630 (1.0)	9,920 (1.2)	10,490 (1.3)	11,135 (1.4)	13,013 (1.6)	13,894 (1.6)	15,119 (1.7)	24,054 (2.5)	25,857 (2.8)	241.6
Whites	610,220 (78.5)	650,020 (77.2)	659,450 (77.1)	607,860 (74.4)	588,060 (73.8)	604,469 (72.6)	625,242 (71.4)	623,366 (70.0)	650,664 (68.8)	654,377 (70.8)	7.2
Others	58,390 (7.5)	69,550 (8.3)	59,780 (7.0)	78,380 (9.6)	71,058 (8.9)	80,661 (9.7)	93,215 (10.6)	104,671 (11.7)	117,920 (12.5)	96,027 (10.4)	64.5

Note. Each years' frequencies refer to all ACT-tested high school students with valid ACT Composite scores by high school graduating class, 1987 to 1996. Frequencies for racial/ethnic subgroups in 1987, 1988, 1989, and 1990 were projected from a systematic 10% sample. Hence, the zero at the end of each number for these years. Percentages are based on the frequencies. "Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: Males comprised 356,704 (45.9%) of the 1987 ACT-tested population and 407,587 (44.1%) of the 1996 population. The population of ACT-tested students changed between 1987 and 1996 by about 19%. The last column indicates that the ACT-tested male population in 1996 was 14.3% larger than it was in 1987.

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TABLE 2

Average ACT *Composite* Scores by High School Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1987 to 1996 Point Gain or Loss
Total Sample	20.7	20.8	20.6	20.6	20.7	20.6	20.7	20.8	20.8	20.9	0.2
Males	21.4	21.4	21.2	21.0	20.9	20.8	20.9	20.9	20.9	21.0	-0.4
Females	20.2	20.2	20.1	20.3	20.5	20.5	20.5	20.7	20.7	20.8	0.6
American Indians	17.3	17.7	17.4	18.0	18.2	18.0	18.4	18.6	18.7	18.6	1.3
Asians	21.7	21.8	21.8	21.7	21.7	21.6	21.7	21.8	21.6	21.6	-0.1
Blacks	16.5	16.6	16.6	17.0	17.0	17.0	17.1	17.0	17.1	17.1	0.6
Mexican-Americans	17.9	18.3	18.1	18.4	18.4	18.4	18.4	18.5	18.6	18.8	0.9
Other Hispanics	19.0	19.3	19.2	19.2	19.5	19.5	19.3	19.3	18.7	18.9	-0.1
Whites	21.4	21.4	21.3	21.2	21.3	21.3	21.3	21.4	21.5	21.6	0.2
Others[a]	19.7	20.1	19.3	20.0	20.2	20.4	20.5	20.7	20.8	20.4	0.7

Note. ACT Composite scores for each year were based on a systematic 10% sample of ACT-tested students by high school graduating class. Scores prior to October 1989 have been converted to the Enhanced ACT Score Scale. [a]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: Females in the ACT-tested sample had average ACT Composite scores of 20.2 in 1987 and 20.8 in 1996. This represents a 1987-1996 Composite score gain of 0.6.

TABLE 3

Average ACT *Mathematics* Test Scores by High School Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1987 to 1996 Point Gain or Loss
Total Sample	20.0	20.0	20.0	19.9	20.0	20.0	20.1	20.2	20.2	20.3	0.3
Males	21.0	20.9	20.8	20.7	20.7	20.7	20.7	20.8	20.9	20.9	-0.1
Females	19.2	19.3	19.2	19.3	19.4	19.5	19.6	19.6	19.7	19.7	0.5
American Indians	16.8	17.2	17.1	17.6	17.8	17.6	17.9	18.0	18.1	18.0	1.2
Asians	22.9	22.9	22.9	22.9	23.0	22.9	22.9	23.1	22.8	22.7	-0.2
Blacks	16.0	16.2	16.4	16.6	16.7	16.9	16.9	16.7	16.8	16.9	0.9
Mexican-Americans	17.5	18.0	18.0	18.1	18.2	18.4	18.4	18.4	18.5	18.7	1.2
Other Hispanics	18.7	18.8	19.1	18.9	19.3	19.4	19.3	19.1	18.6	18.8	0.1
Whites	20.6	20.5	20.5	20.3	20.4	20.4	20.5	20.6	20.7	20.8	0.2
Others[a]	19.3	19.6	19.1	19.6	19.9	20.1	20.3	20.4	20.4	20.0	0.7

Note. ACT Math scores for each year were based on a systematic 10% sample of ACT-tested students by high school graduating class. Scores prior to October 1989 have been converted to the Enhanced ACT Score Scale. [a]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: American Indians in the ACT-tested sample had average ACT Mathematics test scores of 16.8 in 1987 and 18.0 in 1996. This represents a 1987 to 1996 Mathematics score gain of 1.2 points.

TABLE 4

Percentages of ACT-Tested Students Taking[a] Advanced Mathematics and Science Courses in High School by Graduating Class: 1987-1996

Courses Taken/Planned Overall	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Algebra II	76	78	79	80	82	84	85	86	87	88
Geometry	85	87	87	88	89	89	90	91	92	92
Trigonometry	43	43	44	44	46	46	47	48	48	48
Calculus	16	16	16	17	19	19	20	21	22	23
Other Math	32	32	32	34	35	35	37	38	38	40
Chemistry	67	69	70	72	74	75	76	78	80	80
Physics	35	36	37	38	40	40	42	43	44	45

Males - Courses Taken/Planned	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Algebra II	78	80	80	81	83	84	85	86	87	88
Geometry	87	88	88	88	89	90	90	91	92	92
Trigonometry	49	48	48	48	50	50	50	50	50	49
Calculus	20	20	20	21	22	22	23	24	24	26
Other Advanced Math	35	35	35	36	37	37	37	38	39	40
Chemistry	69	71	72	73	74	75	77	78	79	80
Physics	44	45	45	46	47	47	48	49	49	50

Females - Courses Taken/Planned	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Algebra II	74	77	78	80	82	83	84	86	88	89
Geometry	84	86	86	87	88	89	90	91	92	93
Trigonometry	39	39	40	41	43	44	44	46	46	47
Calculus	12	13	13	14	16	17	17	19	20	21
Other Advanced Math	29	30	30	32	33	34	36	37	38	40
Chemistry	64	67	69	70	73	75	76	78	80	81
Physics	27	29	30	32	33	35	36	38	39	41

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment.

How to read: In 1987, 78% of ACT-tested males reported that they had either taken or were planning to take Algebra II prior to high school graduation. By 1996, 88% of males made this report.

TABLE 5

Changes in High School Course Taking[a] and Achievement of ACT-Tested Students, 1987 to 1996

Racial/Ethnic and Gender	Percentage Differences[b] in High School Course Taking 1987 to 1996							ACT Test Score Differences[c] 1987 to 1996	
	Alg II	Geo	Trig	Calc	Other Advan Math	Chem	Physics	Composite	Math
Total Sample	12	7	5	7	8	13	10	0.2	0.3
Males	10	5	0	6	5	11	6	-0.4	-0.1
Females	15	9	8	9	11	17	14	0.6	0.5
American Indians	24	20	11	7	9	20	11	1.3	1.2
Asians	5	2	-2	7	3	6	8	-0.1	-0.2
Blacks	16	14	4	4	7	18	9	0.6	0.9
Mexican-Americans	16	14	12	9	10	19	14	0.9	1.2
Other Hispanics	11	7	-4	3	4	12	3	-0.1	0.1
Whites	12	7	4	7	9	13	10	0.2	0.2
Others[d]	14	9	7	8	9	15	13	0.7	0.7

Note. Percentages were based on a systematic 10% sample of ACT-tested students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' responses to the High School Course/Grade Information section of the ACT Assessment. [b]Positive numbers indicate increased percentages of students taking the courses in 1996 over those of 1987. Negative numbers indicate decreased percentages. Percentage differences in course-taking are derived from Tables 6-12. ACT score point differences are compiled from Tables 2 and 3. [c]Positive numbers indicate average test score gains in 1996 over those of 1987 on either the ACT Mathematics test or the ACT Composite. Negative numbers indicate losses. [d]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: The proportion of ACT-tested American Indians taking Algebra II increased between 1987 and 1996 by 24 percentage points; the proportion taking Geometry increased by 20 percentage points, and the proportion taking Chemistry increased by 20 percentage points. This group also had 1.3 score point gain on the ACT Composite, greater than that of any other racial/ethnic group.

TABLE 6

Percentages of ACT-Tested Students Taking[a] *Algebra II* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	76	78	79	80	82	84	85	86	87	88
Males	78	80	80	81	83	84	85	86	87	88
Females	74	77	78	80	82	83	84	86	88	89
American Indians	59	66	69	71	76	72	78	77	83	83
Asians	87	87	89	89	90	91	91	92	92	92
Blacks	67	70	73	74	75	77	78	79	82	83
Mexican-Americans	69	74	74	77	77	79	81	82	84	85
Other Hispanics	76	74	79	80	81	83	82	86	84	87
Whites	77	79	80	81	83	85	86	87	88	89
Others[b]	72	74	74	77	79	81	83	84	86	86

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 59% of American Indians reported they had either taken or were planning to take Algebra II. In 1996, 83% of this group made this report.

TABLE 7

Percentages of ACT-Tested Students Taking[a] *Geometry* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	85	87	87	88	89	89	90	91	92	92
Males	87	88	88	88	89	90	90	91	92	92
Females	84	86	86	87	88	89	90	91	92	93
American Indians	65	74	74	76	79	78	81	80	86	85
Asians	94	95	95	95	95	94	95	95	95	96
Blacks	76	81	82	83	85	86	86	87	90	90
Mexican-Americans	78	81	84	85	85	88	89	91	91	92
Other Hispanics	86	88	87	89	89	92	91	93	92	93
Whites	86	88	88	89	89	90	90	91	92	93
Others[b]	81	84	83	86	86	87	89	89	90	90

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 65% of American Indians reported they had either taken or were planning to take Geometry. In 1996, 85% of this group made this report.

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TABLE 8

Percentages of ACT-Tested Students Taking[a] *Trigonometry* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	43	43	44	44	46	46	47	48	48	48
Males	49	48	48	48	50	50	50	50	50	49
Females	39	39	40	41	43	44	44	46	46	47
American Indians	28	29	32	35	34	34	35	37	37	39
Asians	71	70	69	69	73	72	70	72	70	69
Blacks	37	37	38	40	41	41	41	41	42	41
Mexican-Americans	33	35	35	37	38	41	43	43	45	45
Other Hispanics	48	48	52	49	51	53	51	50	45	44
Whites	44	44	44	44	46	46	47	48	48	48
Others[b]	41	42	43	45	47	48	48	50	49	48

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 28% of American Indians reported they had either taken or were planning to take Trigonometry. In 1996, 39% of this group made this report.

TABLE 9

Percentages of ACT-Tested Students Taking[a] *Calculus* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	16	16	16	17	19	19	20	21	22	23
Males	20	20	20	21	22	22	23	24	24	26
Females	12	13	13	14	16	17	17	19	20	21
American Indians	9	10	14	12	14	15	15	17	16	16
Asians	40	39	40	42	43	44	44	47	45	47
Blacks	13	13	13	15	15	16	16	17	17	17
Mexican-Americans	13	12	13	13	15	16	19	19	21	22
Other Hispanics	19	21	19	18	20	22	21	22	18	22
Whites	16	16	16	17	18	18	19	21	21	23
Others[b]	17	16	17	19	21	22	22	24	24	25

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 9% of American Indians reported they had either taken or were planning to take Calculus. In 1996, 16% of this group made this report.

TABLE 10

Percentages of ACT-Tested Students Taking[a] *Other Advanced Mathematics Courses* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	32	32	32	34	35	35	37	38	38	40
Males	35	35	35	36	37	37	37	38	39	40
Females	29	30	30	32	33	34	36	37	38	40
American Indians	20	22	22	26	24	26	27	30	28	29
Asians	47	49	46	48	49	50	49	49	50	50
Blacks	25	26	26	28	28	29	31	30	31	32
Mexican-Americans	22	22	24	24	25	28	30	29	34	32
Other Hispanics	32	31	35	32	37	35	36	36	31	36
Whites	32	33	33	34	36	36	37	39	39	41
Others[b]	30	30	29	33	34	35	36	37	39	39

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 20% of American Indians reported they had either taken or were planning to take Other Advanced Mathematics. In 1996, 29% of this group made this report.

TABLE 11

Percentages of ACT-Tested Students Taking[a] *Chemistry* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	67	69	70	72	74	75	76	78	80	80
Males	69	71	72	73	74	75	77	78	79	80
Females	64	67	69	70	73	75	76	78	80	81
American Indians	49	55	58	57	62	63	64	64	68	69
Asians	84	85	85	88	88	88	88	91	91	90
Blacks	59	64	67	69	70	70	73	75	77	77
Mexican-Americans	57	61	64	65	66	70	72	73	76	76
Other Hispanics	68	70	73	72	78	78	76	80	77	80
Whites	68	70	71	72	74	75	77	78	80	81
Others[b]	64	65	67	69	71	73	76	78	80	79

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

How to read: In 1987, 49% of American Indians reported they had either taken or were planning to take Chemistry. In 1996, 69% of this group made this report.

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TABLE 12

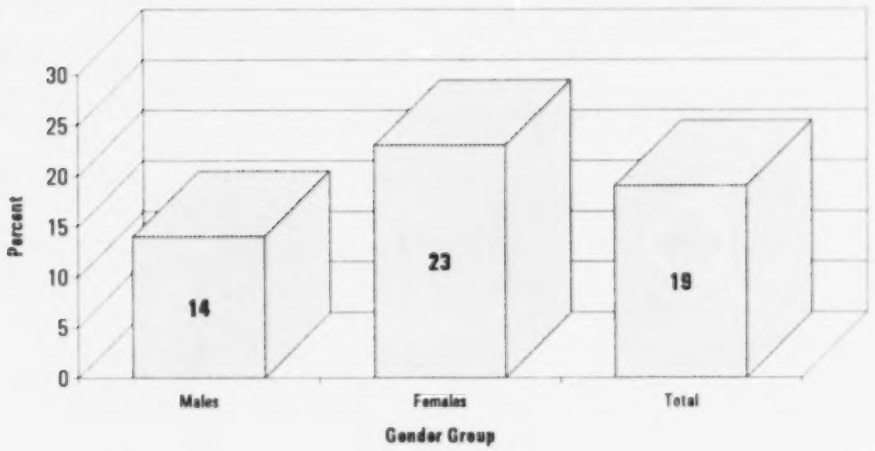
Percentages of ACT-Tested Students Taking[a] *Physics* in High School by Graduating Class: 1987 to 1996

Reference Group	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Total Sample	35	36	37	38	40	40	42	43	44	45
Males	44	45	45	46	47	47	48	49	49	50
Females	27	29	30	32	33	35	36	38	39	41
American Indians	25	26	26	28	30	30	34	33	33	36
Asians	61	64	64	65	67	67	67	68	67	69
Blacks	29	31	32	34	34	34	37	36	38	38
Mexican-Americans	27	27	29	30	32	34	34	36	40	41
Other Hispanics	40	41	42	42	45	45	45	47	40	43
Whites	35	36	37	38	39	40	41	43	44	45
Others[b]	34	36	36	39	41	43	44	45	46	47

Note. Percentages were based on a systematic 10% sample of ACT-tested high school students with valid ACT scores, by high school graduating class, 1987 to 1996. [a]By "taking" we refer to courses taken, currently being taken, or planned for taking before graduation, according to students' response to the "High School Course/Grade Information" section of the ACT Assessment. [b]"Others" includes students who responded "other" and "prefer not to respond" to the racial/ethnic question and those who left the item blank. "Others" also includes international students and, in 1996, those who responded "multi-racial."

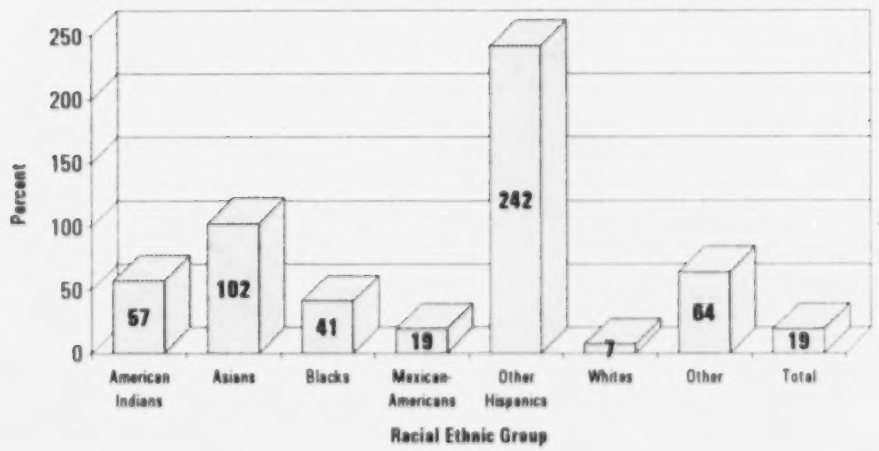
How to read: In 1987, 25% of American Indians reported they had either taken or were planning to take Physics. In 1996, 36% of this group made this report.

FIGURE 1. **Percent Changes in the Number of ACT-Tested Students by Gender Groups from 1987 to 1996**



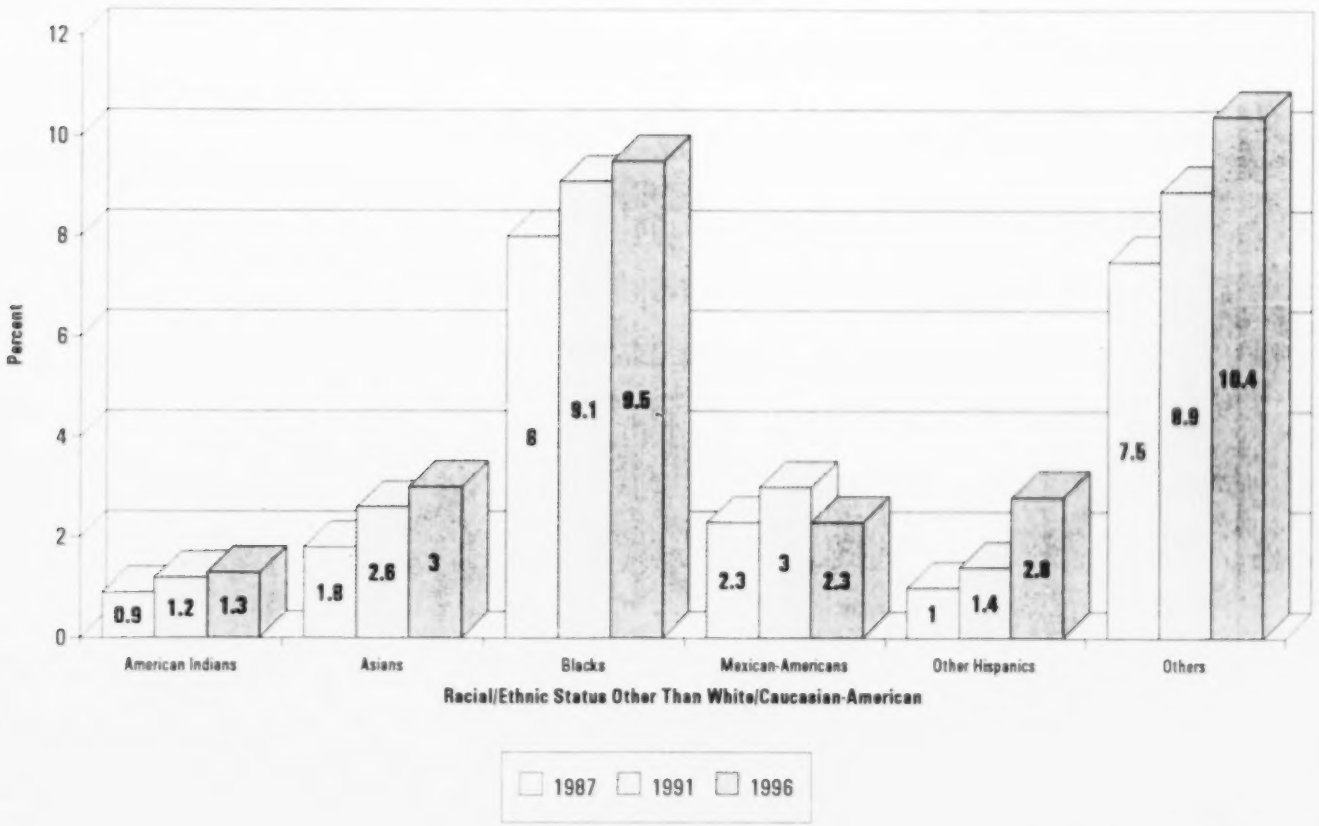
Note. Data for this figure were based on Table 1. Percent changes were rounded.

FIGURE 2. **Percent Changes in the Number of ACT-Tested Students by Racial/Ethnic Group from 1987 to 1996**



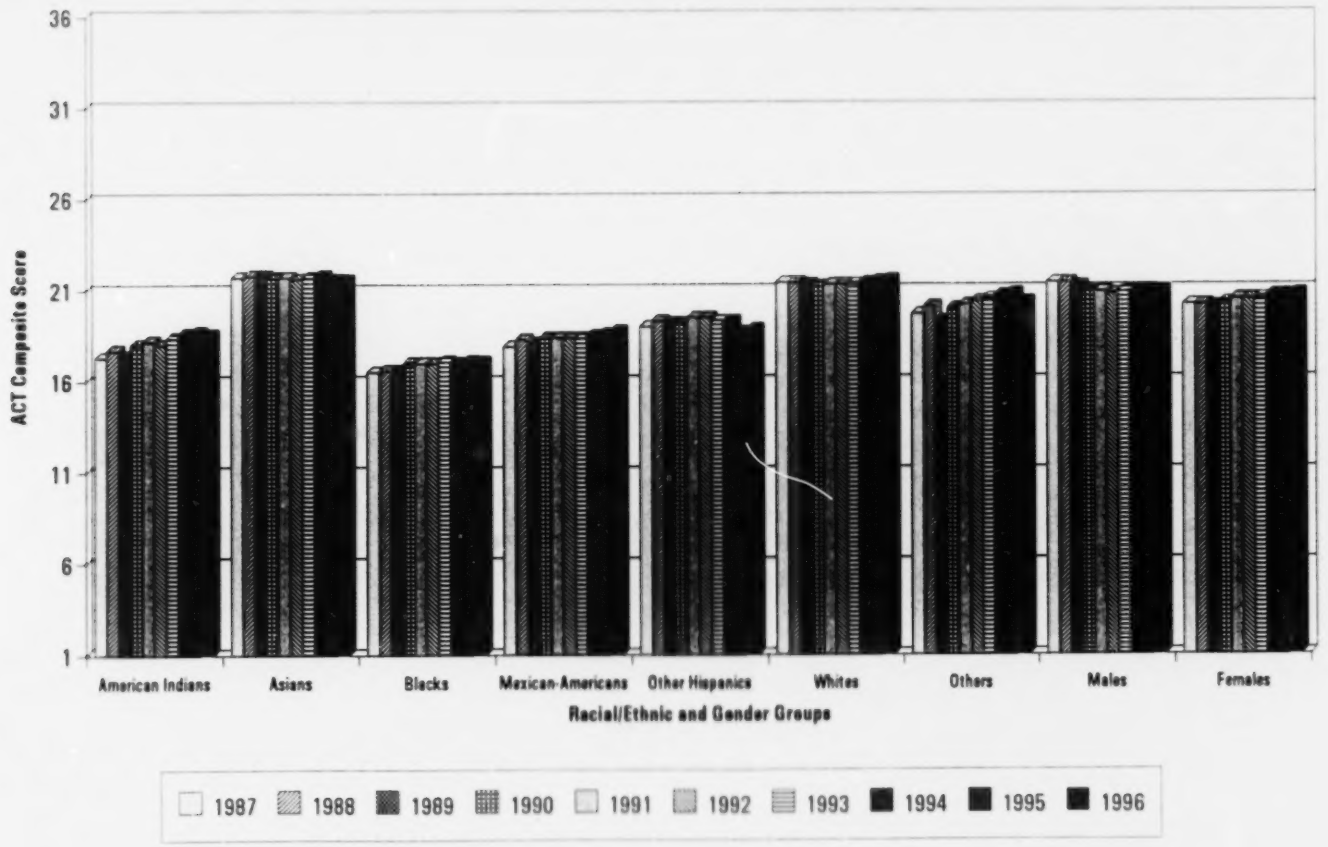
Note. Data for this figure were based on Table 1. Percent changes were rounded.

FIGURE 3. **Percentage of ACT-Tested Students Indicating Racial/Ethnic Status Other Than White/Caucasian-American by Graduating Class: 1987, 1991, and 1996**



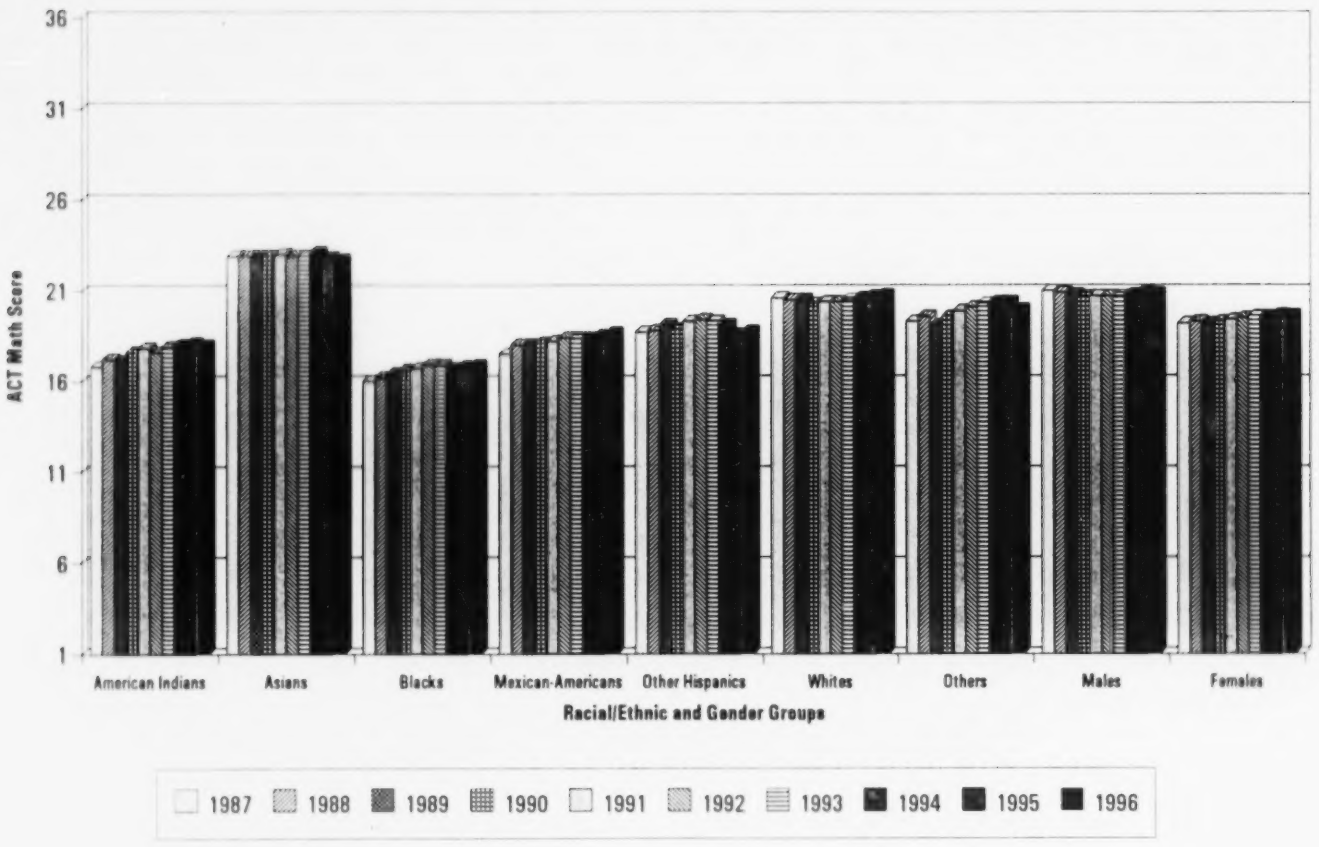
Note. Data for this figure are based on Table 1, which presents the frequencies and percentages of all ACT-test-takers with valid ACT Composite scores.

FIGURE 4. **Average ACT Composite Scores of an Annual 10% Sample by High School Graduating Class: 1987 to 1996**



Note. Data for this figure were based on Table 2.

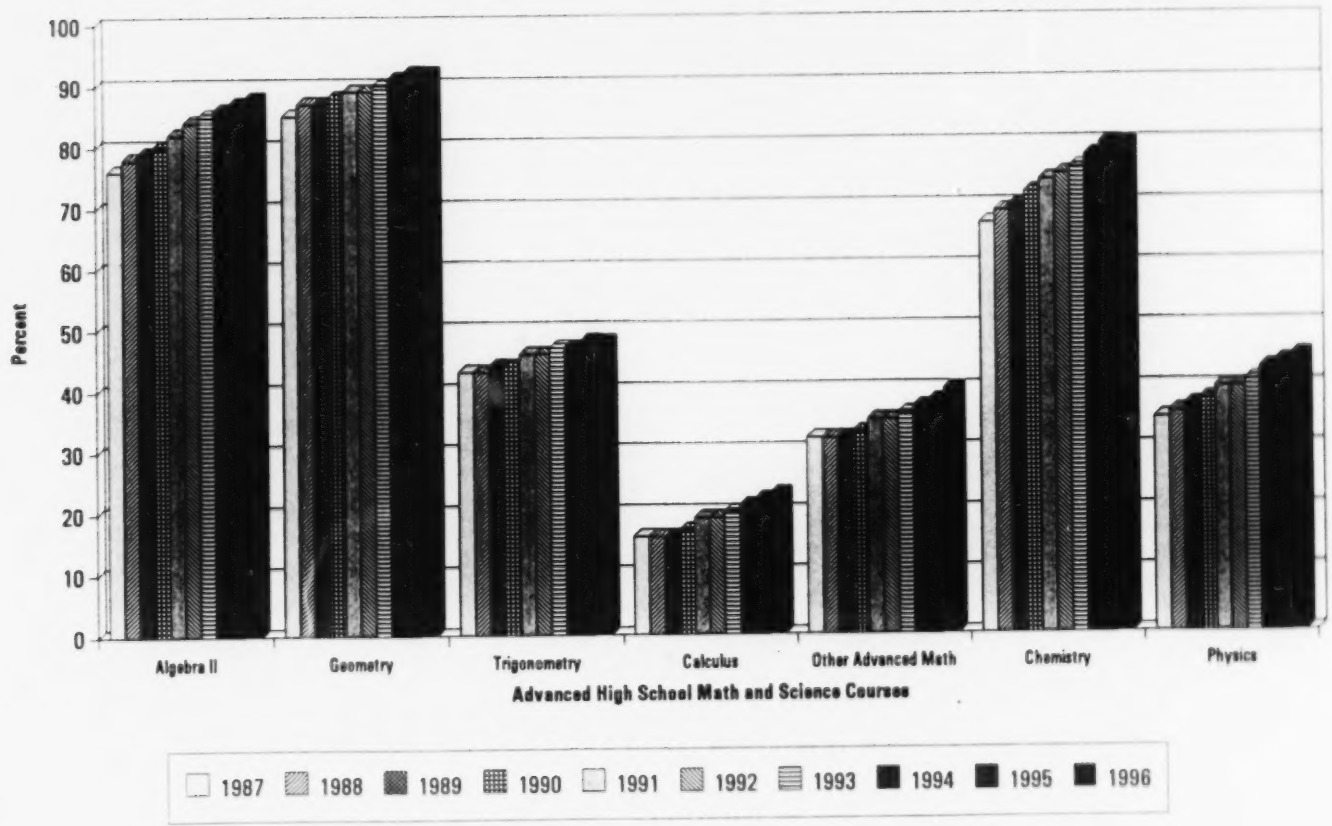
FIGURE 5. **Average ACT Math Scores of Annual 10% Sample by High School Graduating Class: 1987 to 1996**



46

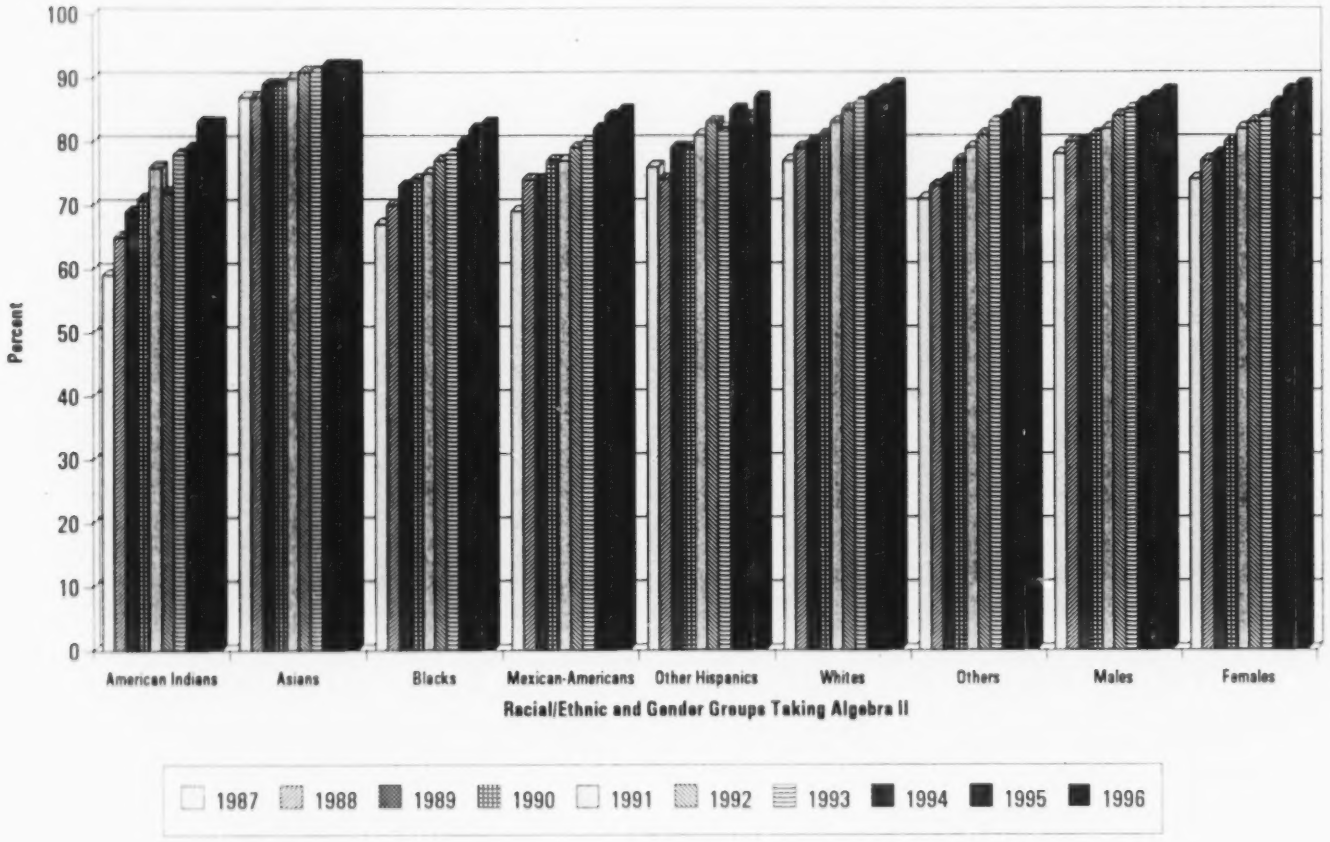
Note. Data for this figure were based on Table 3.

FIGURE 6. **Percentage of ACT-Tested Students Taking Advanced Math and Science Courses in High School by Graduating Class: 1987 to 1996**



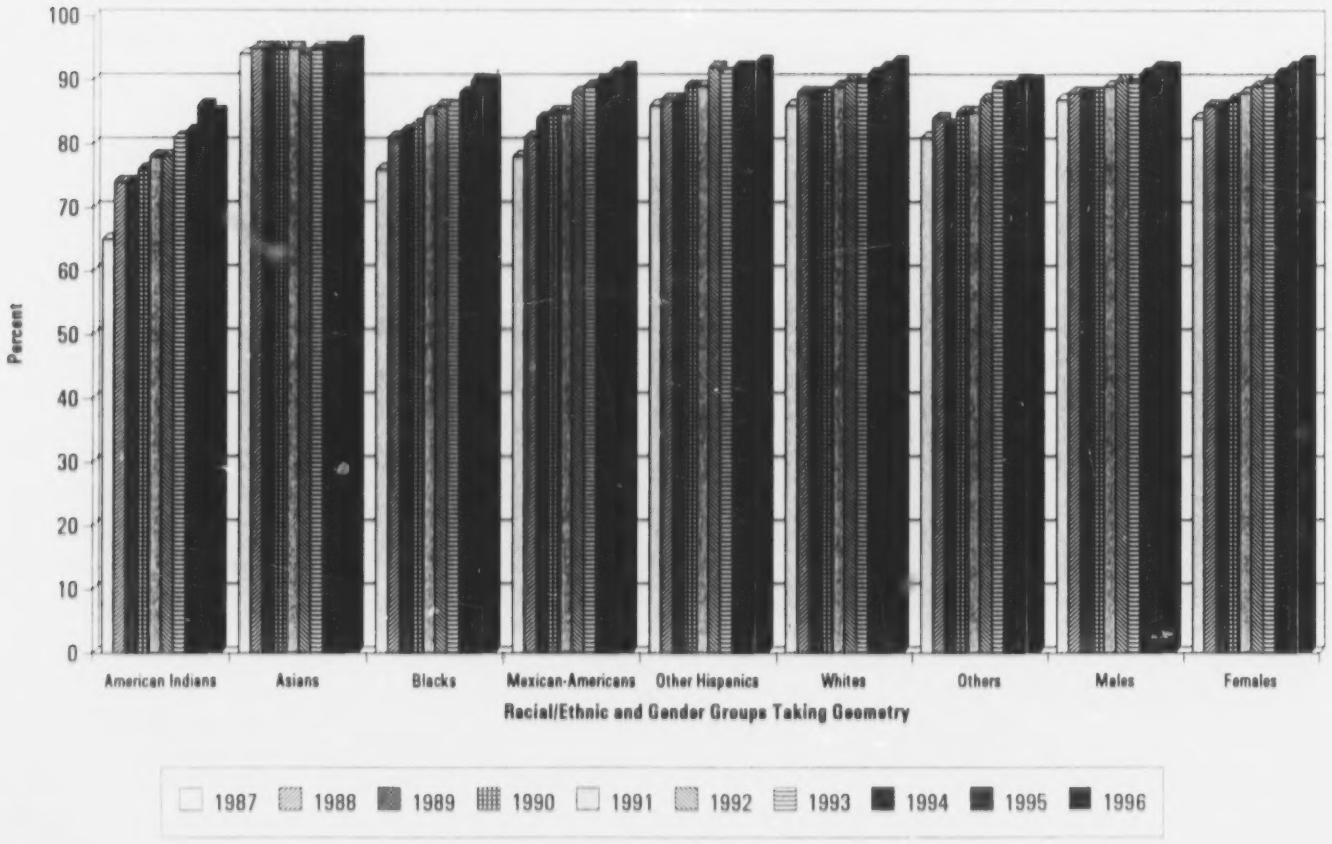
Note. Data for this figure were based on Table 4.

FIGURE 7. **Percentage of ACT-Tested Students Taking Algebra II in High School by Graduating Class: 1987 to 1996**



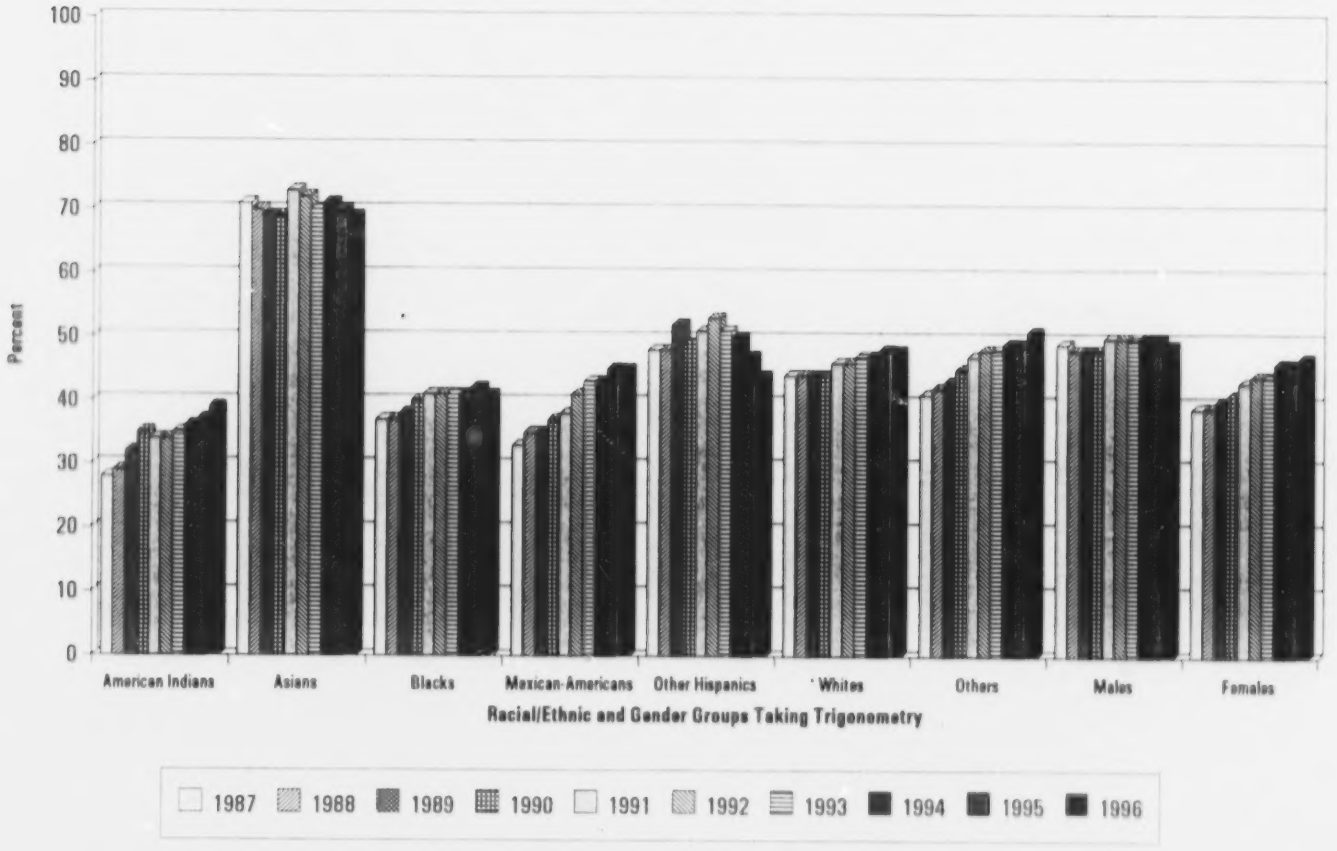
Note. Data for this figure were based on Table 6.

FIGURE 8. **Percentage of ACT-Tested Students Taking Geometry in High School by Graduating Class: 1987 to 1996**



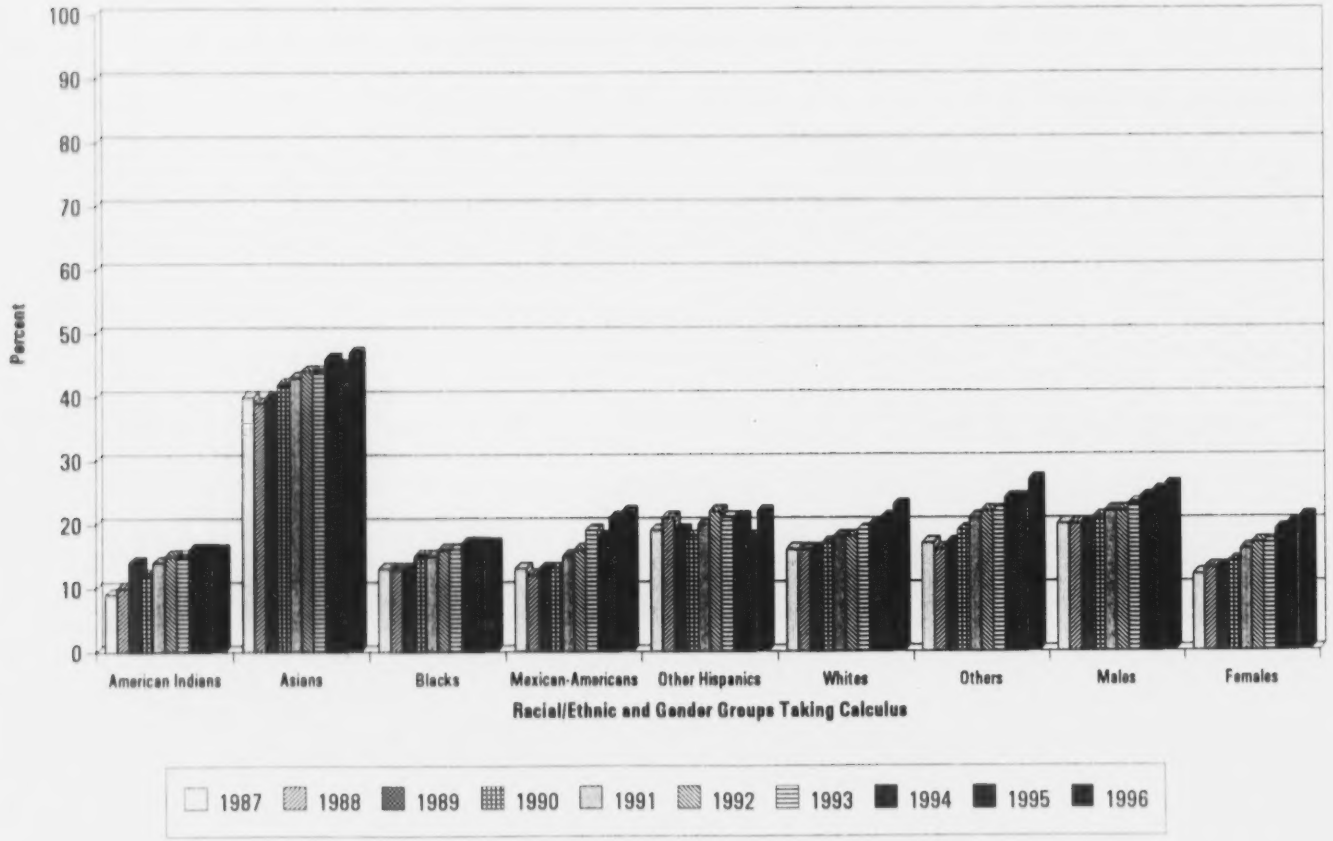
Note. Data for this figure were based on Table 7.

FIGURE 9. **Percentage of ACT-Tested Students Taking Trigonometry in High School by Graduating Class: 1987 to 1996**



Note. Data for this figure were based on Table 8.

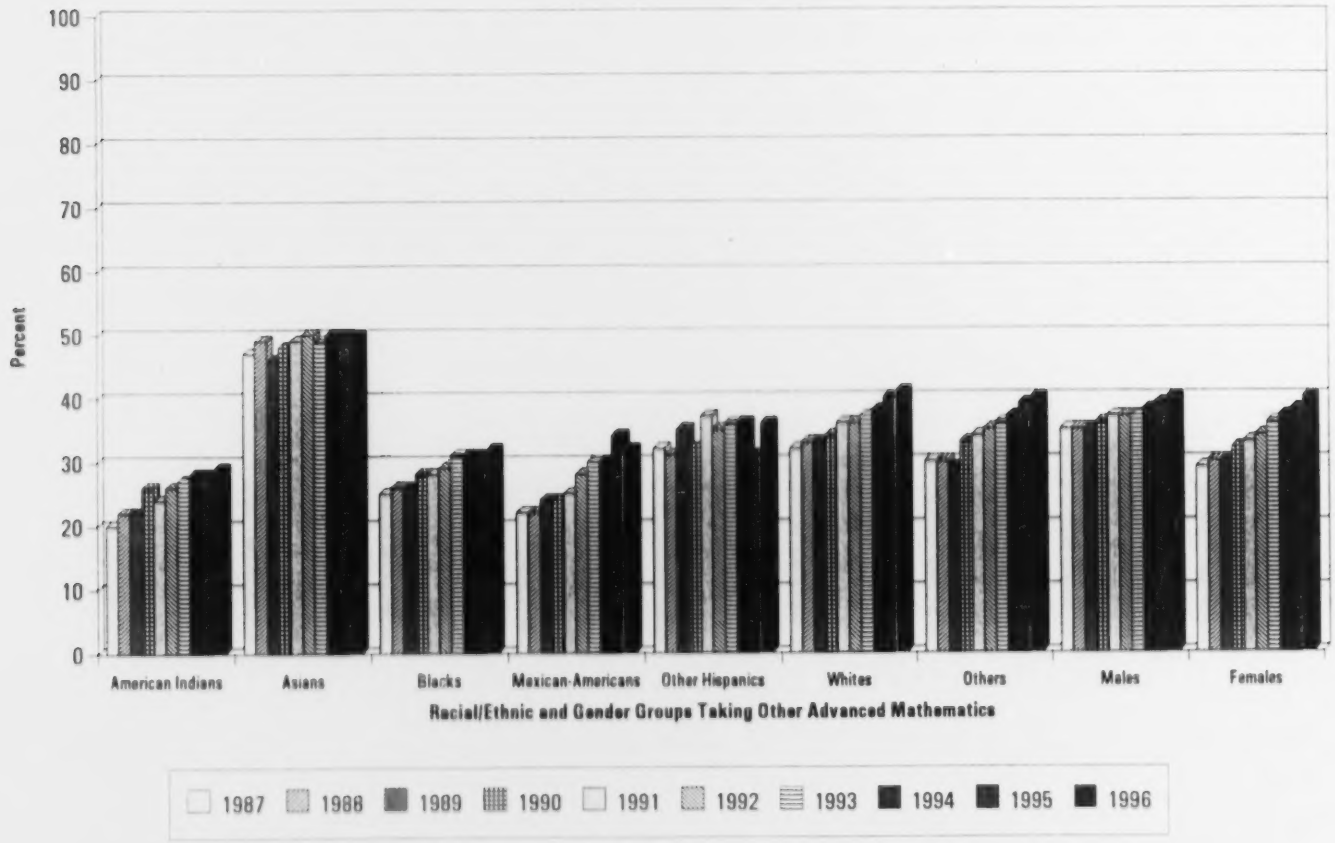
FIGURE 10. **Percentage of ACT-Tested Students Taking Calculus in High School by Graduating Class: 1987 to 1996**



Note. Data for this figure were based on Table 9.

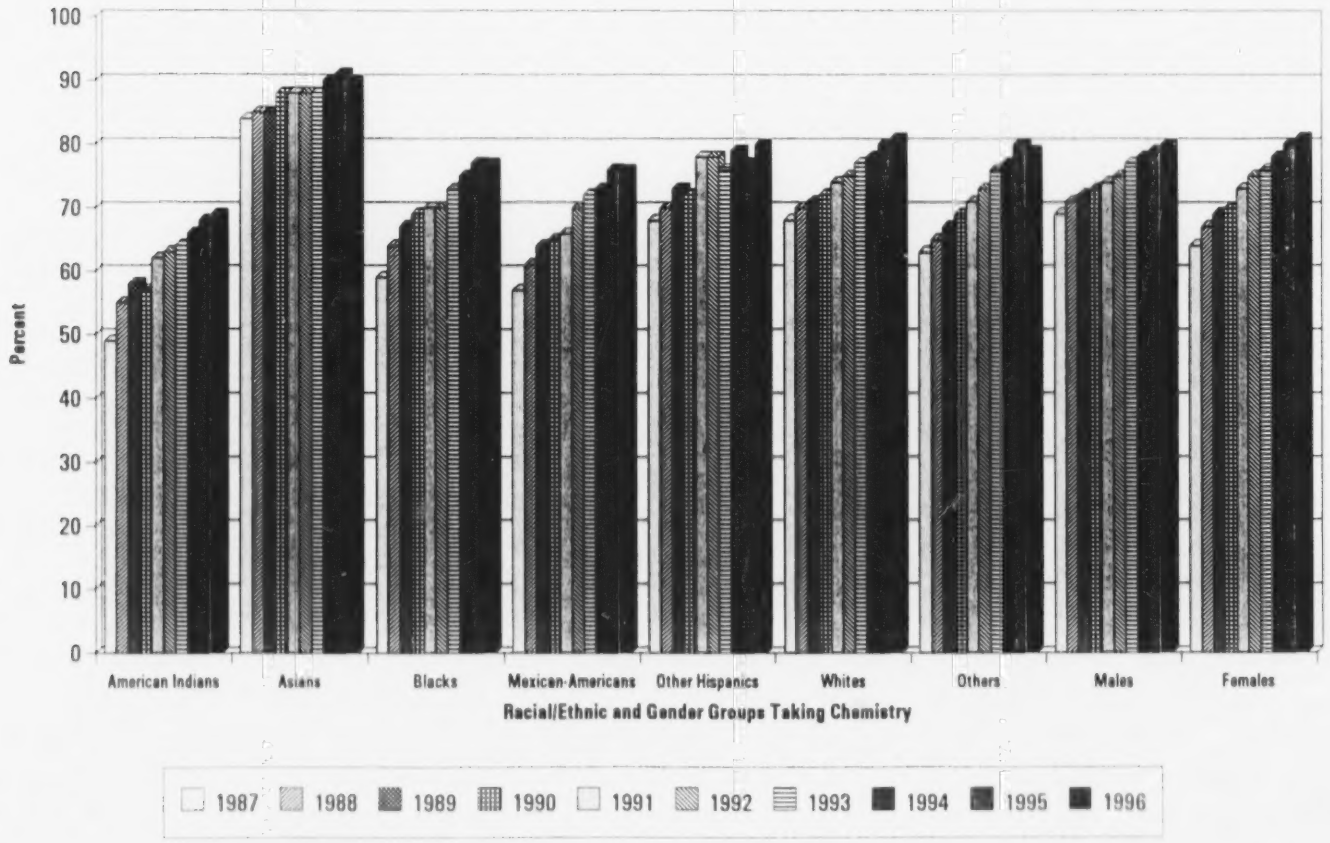
58

FIGURE 11. **Percentage of ACT-Tested Students Taking Other Advanced Mathematics in High School by Graduating Class: 1987 to 1996**



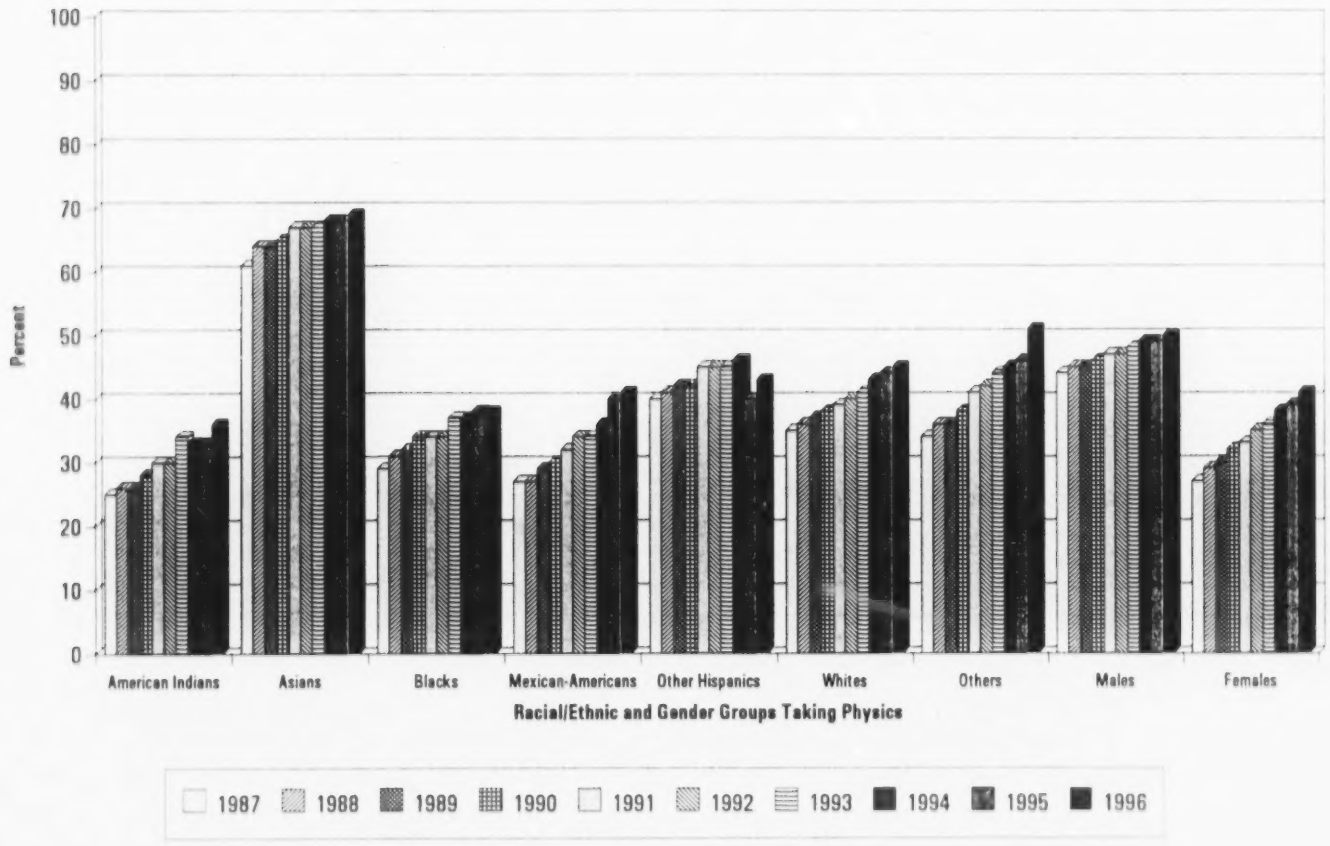
Note. Data for this figure were based on Table 10.

FIGURE 12. **Percentage of ACT-Tested Students Taking Chemistry in High School by Graduating Class: 1987 to 1996**



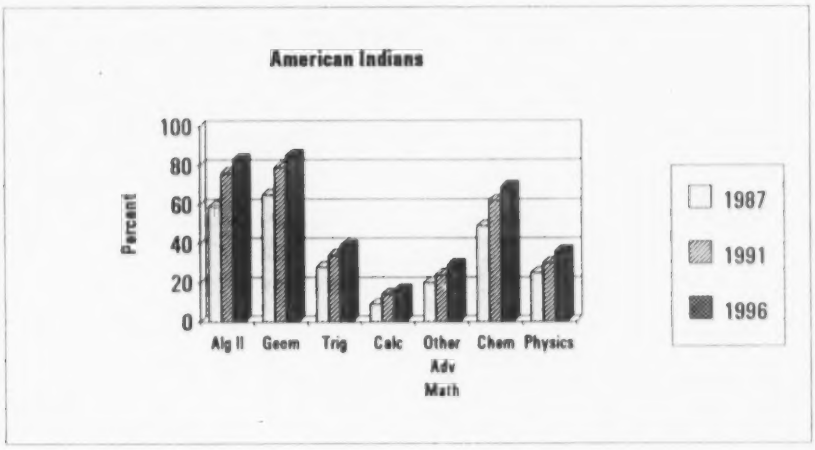
Note. Data for this figure were based on Table 11.

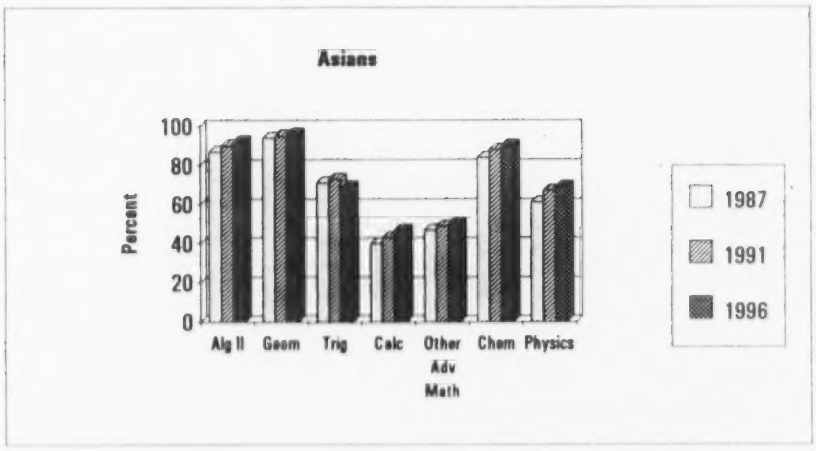
FIGURE 13. **Percentage of ACT-Tested Students Taking Physics in High School by Graduating Class: 1987 to 1996**



Note. Data for this figure were based on Table 12.

FIGURE 14. **Percentage of ACT-Tested Students by Racial/Ethnic Group Taking Advanced Mathematics and Science Courses by High School Graduating Class: 1987, 1991, and 1996**





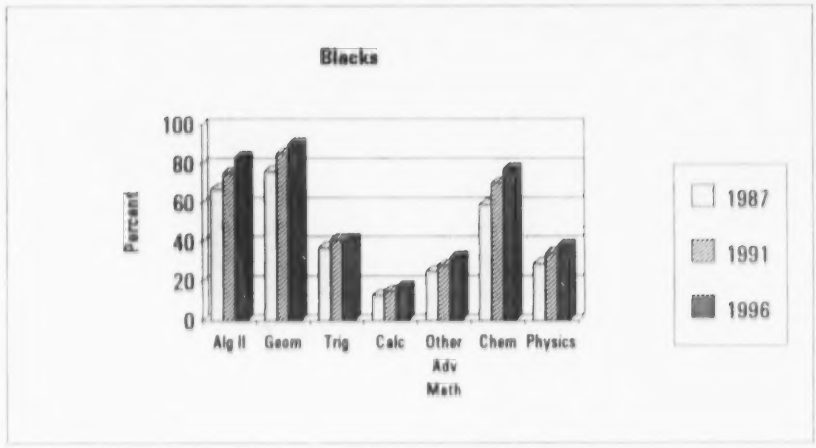


FIGURE 14. (Cont'd) Percentage of ACT-Tested Students by Racial Ethnic Group Taking Advanced Mathematics and Science Courses by High School Graduating Class: 1987, 1991, and 1996